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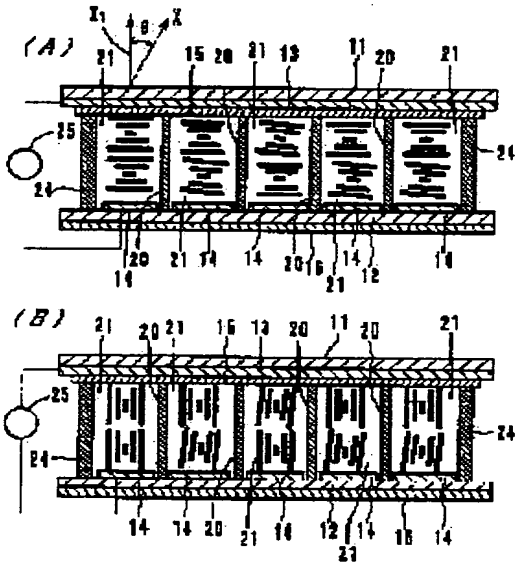
(54) LIQUID CRYSTAL DISPLAY ELEMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a reflection-type liquid crystal display element which is superior in bi stability, whose characteristic such as color purity is satisfactory, whose contract is high and in which ed color balance is not lost even in full color display.
SOLUTION: A reflection-type liquid crystal display element where a quid crystal composition 21 which shows a coresteric phase at a room emperature and whose selected reflection wavelength is adjusted within he range of 690-710 nm is sandwiched by substrates 11 and 12 where TO electrodes 13 and 14 are formed is provided. The liquid crystal omposition 21 is mainly constituted of a kiral nematic liquid crystal omponent that is mainly composed of at least one compound selected rom a ground formed of liquid crystal line tolan compound, liquid crystal ne pyrimidine compound, liquid crystal line ester compound and liquid rystal line cyanobiphenyl compound.



EGAL STATUS

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CLAIMS

(Claim(s)]

(Claim 1] The liquid crystal display component characterized by pinching the liquid crystal constituent adjusted between the substrates of a pair at least with transparent one side at within the limits the selective reflection wavelength of whose is 690-710nm while a room temperature shows a cholesteric phase.

Claim 2] Said liquid crystal constituent is a liquid crystal display component according to claim 1 characterized by using as a principal component the chiral pneumatic liquid crystal component containing at least one compound chosen from the group which consists of a liquid crystallinity tolan compound, a liquid crystallinity pyrimidine compound, a liquid crystallinity ester compound, and a liquid crystallinity cyano biphenyl compound, and chiral material.

Claim 3] Said liquid crystal constituent is a liquid crystal display component according to claim 1 or 2 characterized by including dichroic coloring matter.

Claim 4] The full color liquid crystal display component characterized by carrying out the laminating of the display device containing the liquid crystal display component for red reflex according to claim 1, the display device containing the chiral pneumatic liquid crystal component for green reflection, and the chiral pneumatic liquid crystal component for blue reflection.

Translation done.]

)ETAILED DESCRIPTION

Detailed Description of the Invention]
0001]
Field of the Invention] This invention relates to a liquid crystal display component and the liquid crystal display :omponent of the bistability / reflective mold which used in detail the liquid crystal in which a cholesteric phase s shown at a room temperature.
0002]
Description of the Prior Art] The liquid crystal display component of the reflective mold using the chiral neumatic liquid crystal which showed the cholesteric phase in the room temperature is variously studied by dding chiral material to a pneumatic liquid crystal in recent years. With this component, it displays by switching quid crystal to a planar condition and a focal conic condition by ON of an electrical potential difference, and)FF.
0003] However, with the liquid crystal display component of the reflective mold which used the chiral pneumatic quid crystal till today, contrast sufficient in a planar condition and the focal conic condition could not be cquired, and what fully satisfied properties, such as color purity, did not exist. This trouble was remarkable in he reflective mold liquid crystal display component currently especially used as an object for a red display onventionally. Moreover, it also had the trouble that such a reflective mold liquid crystal display component for red display will have a large angle-of-visibility dependency, and a tint will change with the include angles which bserve a display device. Therefore, when the laminating of the component for each color specification, such as ed, green, and blue, was carried out for a full color display, it also had the trouble that red color balance ollapsed.
0004] Then, the purpose of this invention is to offer the liquid crystal display component of the reflective mold vith which red color balance does not collapse even if it excels in bistability nature, properties, such as color urity, are good, and contrast is high and it is a full color display.
0005]
The configuration, an operation, and effectiveness] of invention In order to attain the above purpose, while the quid crystal display component concerning this invention shows a cholesteric phase at a room temperature etween the substrates of a pair at least with transparent one side, the liquid crystal constituent adjusted at vithin the limits the selective reflection wavelength of whose is 690-710nm is pinched.
0006] In this invention, since the chiral pneumatic liquid crystal which shows a cholesteric phase at a room emperature was adjusted to within the limits whose selective reflection wavelength is 690-710nm, color purity is ood and can obtain the liquid crystal display component of the high reflective mold of contrast. Especially, a red ngle-of-visibility dependency decreases and repeatability improves. Moreover, in order to display FURUKARA, hen the laminating of each component for the object for red reflex, the object for green reflection, and blue eflection is carried out, red color balance improves.
0007]
Embodiment of the Invention] Hereafter, the operation gestalt of the liquid crystal display component oncerning this invention is explained with reference to an accompanying drawing.
0008] (The configuration and display action of the 1st operation gestalt) The cross-section structure of the quid crystal display component which is the 1st operation gestalt of this invention is shown in drawing 1 . (A) ows the planar condition (RGB coloring condition) when impressing a high-voltage pulse, and (B) shows the cal conic condition (transparence / black display condition) when impressing a low-battery pulse.
0009] In drawing 1 , 11 and 12 are transparence substrates and transparent electrodes 13 and 14 are formed in ach front face in the shape of a matrix. It is desirable that coating of the insulating thin film 15 is carried out on electrode 13. Moreover, according to the need for a display, the light absorption layer 16 is formed in the rear ce of a substrate 12. It is the liquid crystal constituent which 20 shows a columnar structure object to at a om temperature, and 21 shows a cholesteric phase, and these ingredient and its combination are explained to low, and the following examples of an experiment explain concretely further. 24 is a sealant and is for closing e liquid crystal constituent 21 between a substrate 11 and 12. 25 is a pulse power source and impresses a

predetermined pulse-like electrical potential difference to said electrodes 13 and 14.
[0010] In the liquid crystal display component which consists of the above configuration, a display is performed by impressing a pulse voltage to electrodes 13 and 14 from a power source 25. That is, when the liquid crystal constituent uses what shows a cholesteric phase, by impressing a comparatively high pulse voltage, liquid crystal will be in a planar condition and the light of the wavelength decided based on a cholesteric pitch and a refractive index will be reflected alternatively. By impressing a comparatively low pulse voltage, liquid crystal will be in a focal conic condition, and will be in a transparence condition. In addition, as shown in drawing 1 , when the light absorption layer 16 is formed, black will be displayed in the state of focal conic.
[0011] With this liquid crystal display component, the field where the matrix-like electrodes 13 and 14 cross serves as a display pixel. On these specifications, the field where light modulation is performed with liquid crystal is called a viewing area, and the circumference becomes the outside of the viewing area to which light modulation is not performed.
[0012] (Substrate) Substrates 11 and 12 need for at least one side to be transparent. As a transparent substrate, flexible substrates, such as a polycarbonate, polyether sulphone, and polyethylene terephthalate, etc. are usable in addition to glass.
[0013] (Electrode) As electrodes 13 and 14, photoconductivity film, such as metal electrodes, such as transparent conductive film represented by ITO (Indium Tin Oxide), aluminum, and silicon, or an amorphous silicon, and BSO (Bismuth Silicon Oxide), is usable. What is necessary is just to carry out patterning by the photolithography method, after forming the ITO film by the sputtering method etc. on a substrate 11 and 12 in order to form electrodes 13 and 14 in the shape of a matrix for example.
[0014] (An insulator layer, orientation film) The insulating thin films 15 are organic film, such as inorganic film, such as silicon oxide, or polyimide resin, and an epoxy resin, and the short circuit between an electrode 13 and 14 is prevented, or they have the function which raises the dependability of liquid crystal as a gas barrier layer. Moreover, on an electrode 13 and 14, the orientation film represented by polyimide resin may be arranged if needed. Furthermore, the same ingredient as the macromolecule object used for the columnar structure object 20 may be used as an insulator layer or orientation film.
[0015] (Spacer) Although not illustrated by drawing 1 , a spacer may be inserted between a substrate 11 and 12. This spacer is a solid sphere which consists of resin or an inorganic oxide, and holds the gap between a substrate 11 and 12 to homogeneity.
[0016] (Liquid crystal constituent) The pneumatic liquid crystal which uses as a principal component at least one compound chosen from the group which consists of a liquid crystallinity tolan compound, a liquid crystallinity pyrimidine compound, a liquid crystallinity ester compound, or a liquid crystallinity cyano biphenyl compound is contained, as a room temperature shows a cholesteric phase further, what added chiral material is used, and a liquid crystal constituent may add dichroic coloring matter.
[0017] According to examination of this invention persons, it became clear that it is important for the display property of a component to set the selective reflection wavelength of a reflective mold liquid crystal display component as the suitable wavelength range. this invention persons found out that an angle-of-visibility dependency could be reduced by setting this as the range of 690-710nm to selective reflection wavelength having become near 680nm with the conventional reflective mold liquid crystal display component for a red display, keeping bistability nature and color purity good, as a result of examining many things. From such a viewpoint, the liquid crystal constituent used for the display device of this operation gestalt is prepared so that selective reflection wavelength may become within the limits which is 690-710nm. Adjustment of selective reflection wavelength should just change the addition of chiral material. Generally, if the addition of chiral material is made to increase, selective reflection wavelength will shift to a short wavelength side. Moreover, selective reflection wavelength means the peak wavelength in the light field of a reflected light spectrum when a pulse voltage is impressed to said electrodes 13 and 14 and liquid crystal changes into a planar condition.
[0018] As chiral material added, various kinds of chiral material known conventionally, such as an ester compound, a pyrimidine compound, an azoxy compound, and a tolan compound, is usable. 5 - 30wt% of an addition is good to a liquid crystal component. The case where desired selective reflection wavelength is unrealizable is produced, and there is a case where it stops showing a cholesteric phase at a room temperature, more than at 30wt% less than [5wt%].
[0019] As coloring matter added, various kinds of dichroic coloring matter known conventionally is usable. As for an addition, less than [3wt%] is desirable to the total quantity of a liquid crystal component and chiral material.
[0020] (Columnar structure object) About the columnar structure object 20, a structure side is explained first. The columnar structure objects 20 are the cylindrical object and square pole-like object arranged at spacing fixed to predetermined patterns, such as a lattice, and an elliptic-cylinder-like object. The thing of the shape of a stripe arranged at intervals of predetermined may be used. As for this columnar structure object 20, it is desirable that they are arrays considered as being able to hold the gap of substrates 11 and 12 appropriately, and not barring image display, such as not a random array but a regular intervals array, an array from which spacing changes gradually, and an array by which a predetermined arrangement pattern is repeated a fixed

period. If the area percentage of occupying to a viewing area is 1 - 40%, while the columnar structure object 20 will hold sufficient reinforcement, practically sufficient property as a display device is acquired.

[0021] Next, an ingredient is explained. The columnar structure object 20 is formed in a polymerization nature monomer (monomer) using the polymerization nature constituent which comes to add a polymerization initiator. The commercial photo-setting resin ingredient which consists of mixed liquor which mixed a photoresist monomer or oligomer, and a photopolymerization initiator as a polymerization nature constituent, for example can be used. If an optical exposure is carried out, a polymerization is carried out to a photo-setting resin ingredient and a columnar structure object is formed, it will become easy to arrange a columnar structure object at intervals of a predetermined configuration.

TECHNICAL FIELD

[Field of the Invention] This invention relates to a liquid crystal display component and the liquid crystal display component of the bistability / reflective mold which used in detail the liquid crystal in which a cholesteric phase is shown at a room temperature.

[Translation done.]

EFFECT OF THE INVENTION

The configuration, an operation, and effectiveness] of invention In order to attain the above purpose, while the liquid crystal display component concerning this invention shows a cholesteric phase at a room temperature between the substrates of a pair at least with transparent one side, the liquid crystal constituent adjusted at within the limits the selective reflection wavelength of whose is 690-710nm is pinched.

0006] In this invention, since the chiral pneumatic liquid crystal which shows a cholesteric phase at a room emperature was adjusted to within the limits whose selective reflection wavelength is 690-710nm, color purity is ood and can obtain the liquid crystal display component of the high reflective mold of contrast. Especially, a red ngle-of-visibility dependency decreases and repeatability improves. Moreover, in order to display FURUKARA, hen the laminating of each component for the object for red reflex, the object for green reflection, and blue eflection is carried out, red color balance improves.

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Embodiment of the Invention] Hereafter, the operation gestalt of the liquid crystal display component oncerning this invention is explained with reference to an accompanying drawing.

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0014] (An insulator layer, orientation film) The insulating thin films 15 are organic film, such as inorganic film, ch as silicon oxide, or polyimide resin, and an epoxy resin, and the short circuit between an electrode 13 and is prevented, or they have the function which raises the dependability of liquid crystal as a gas barrier layer. oreover, on an electrode 13 and 14, the orientation film represented by polyimide resin may be arranged if

needed. Furthermore, the same ingredient as the macromolecule object used for the columnar structure object 20 may be used as an insulator layer or orientation film.

[0015] (Spacer) Although not illustrated by drawing 1 , a spacer may be inserted between a substrate 11 and 12.

TECHNICAL PROBLEM

[Description of the Prior Art] The liquid crystal display component of the reflective mold using the chiral pneumatic liquid crystal which showed the cholesteric phase in the room temperature is variously studied by adding chiral material to a pneumatic liquid crystal in recent years. With this component, it displays by switching liquid crystal to a planar condition and a focal conic condition by ON of an electrical potential difference, and OFF.

[0003] However, with the liquid crystal display component of the reflective mold which used the chiral pneumatic liquid crystal till today, contrast sufficient in a planar condition and the focal conic condition could not be acquired, and what fully satisfied properties, such as color purity, did not exist. This trouble was remarkable in the reflective mold liquid crystal display component currently especially used as an object for a red display conventionally. Moreover, it also had the trouble that such a reflective mold liquid crystal display component for a red display will have a large angle-of-visibility dependency, and a tint will change with the include angles which observe a display device. Therefore, when the laminating of the component for each color specification, such as red, green, and blue, was carried out for a full color display, it also had the trouble that red color balance collapsed.

[0004] Then, the purpose of this invention is to offer the liquid crystal display component of the reflective mold with which red color balance does not collapse even if it excels in bistability nature, properties, such as color purity, are good, and contrast is high and it is a full color display.

Translation done.]

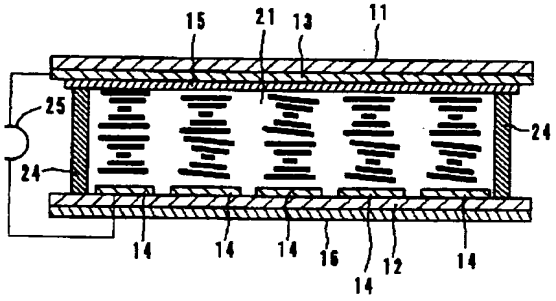
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view showing the 1st operation gestalt of the liquid crystal display component concerning this invention and (A) show a planar condition, and (B) shows a focal conic condition.
[Drawing 2] The sectional view showing the 2nd operation gestalt of the liquid crystal display component concerning this invention and (A) show a planar condition, and (B) shows a focal conic condition.
[Drawing 3] The sectional view showing the 3rd operation gestalt of the liquid crystal display component concerning this invention.
[Drawing 4] The sectional view showing the 4th operation gestalt of the liquid crystal display component concerning this invention.
[Drawing 5] The sectional view showing the 5th operation gestalt of the liquid crystal display component concerning this invention.
[Drawing 6] The chromaticity diagram showing the color reproduction nature of the example of an experiment, and the example of a comparison.
[Drawing 7] The chromaticity diagram showing the color balance of the example of an experiment, and the example of a comparison.
[Description of Notations]
1 12 -- Substrate
3 14 -- Electrode
5 -- Insulating thin film
6 -- Light absorption layer
10 20' -- Columnar structure object
11 -- Liquid crystal constituent
12 -- Bipolar membrane
13 -- Resin constituent
15 -- Power source

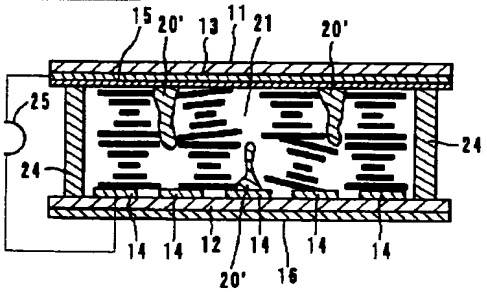
Translation done.]

DRAWINGS

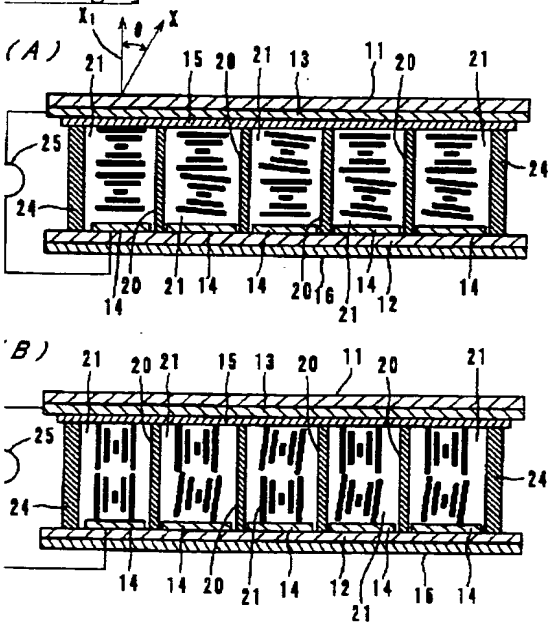
Drawing 3]



Drawing 4]

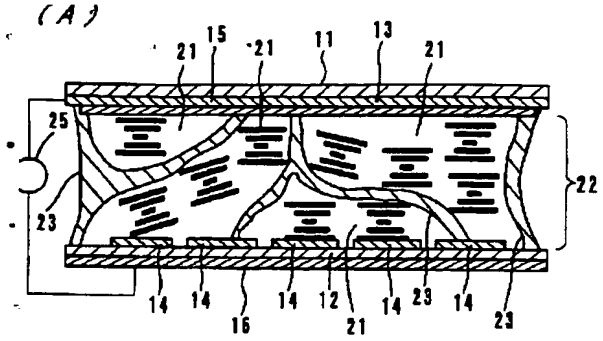


Drawing 1]



Drawing 2]

(A)



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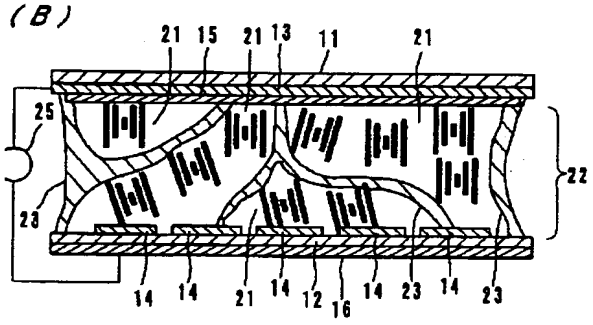

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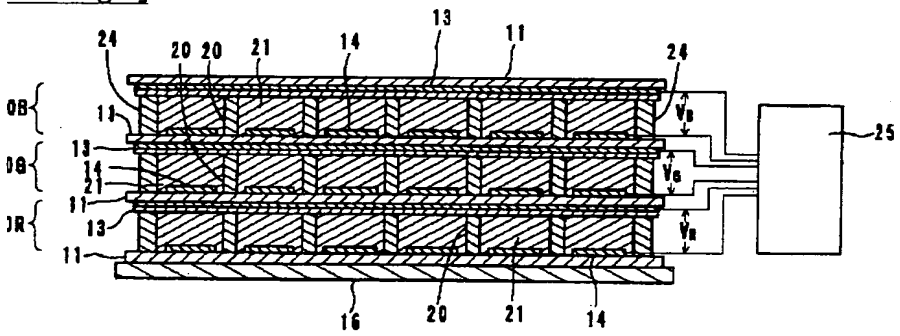

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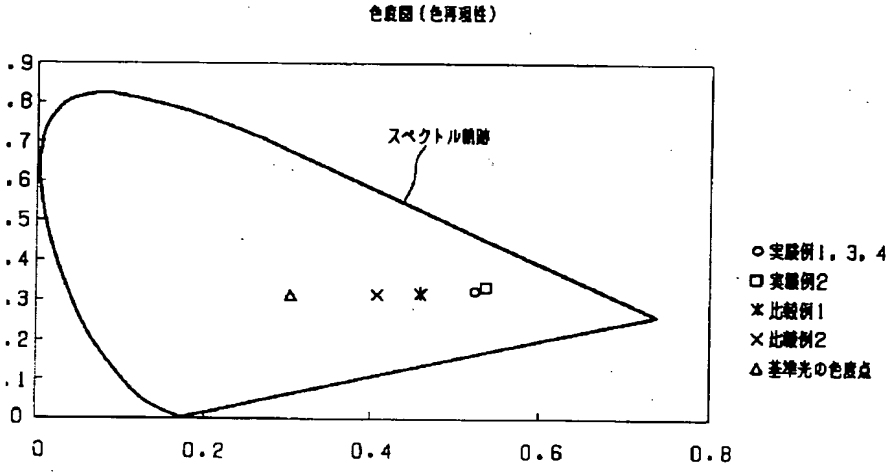
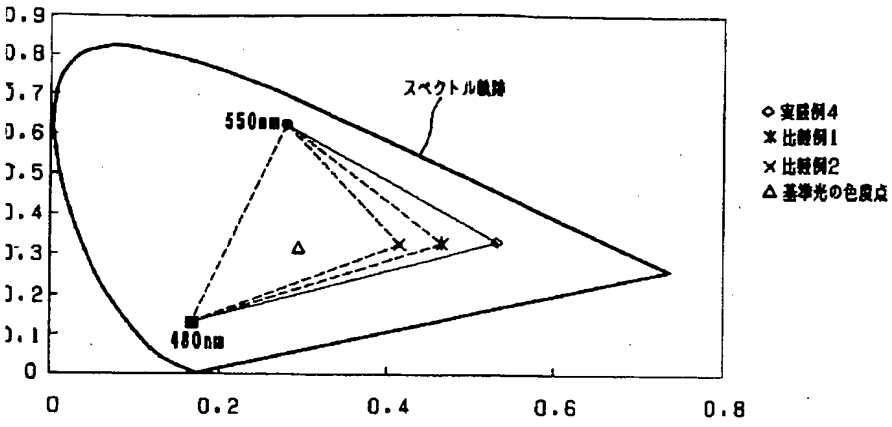


Drawing 7]

色度図（色バランス）



[Translation done.]